OVEREXPRESSION OF ARABIDOPSIS PHYTOCHELATIN SYNTHASE ENHANCES Cd TOLERANCE AND ACCUMULATION IN NICOTIANA TABACUM

A. DE PAOLIS*, M. POMPONI**, V. DI GIROLAMO***, P. COSTANTINO**, M. CARDARELLI***

*) Istituto di Scienze delle Produzioni Alimentari CNR (ISPA), Lecce, Italy  
**) Dipartimento di Genetica e Biologia Molecolare, Università La Sapienza, Rome, Italy  
mirella.pomponi@uniroma1.it  
***) Istituto Biologia e Patologia Molecolari, CNR, Università La Sapienza, Rome, Italy  
maura.cardarelli@uniroma1.it

Phytochelatins (PCs) are metal binding peptides involved in heavy metal detoxification. PCs are synthesized enzymatically from GSH and the reaction is catalyzed by a transpeptidase, phytochelatin synthase (PCS), that is active only in the presence of metal ions. Contrasting results have been obtained by different authors about the effect of PCS1 gene overexpression on heavy metal tolerance 1,2. We overexpressed the Arabidopsis phytochelatin synthase gene (AtPCS1) in the non-accumulator plant Nicotiana tabacum. Normal plants and plants harbouring the Agrobacterium rhizogenes rolB oncogene were transformed 3. We demonstrated that overexpression of AtPCS1 increases Cd tolerance and accumulation, in roots and shoots of AtPCS1 overexpressing tobacco plants. However glutathione is a rate-limiting factor for the synthesis of phytochelatin 4. To assess the possible role of PCs in Cu, Zn and Pb tolerance, we compared root growth inhibition caused by these metals on AtPCS1 overexpressing tobacco plants. rolB-PCS1 seedlings were grown in the presence of different concentrations of CuSO4, ZnSO4 and PbSO4. Preliminary results indicate an increase in Pb tolerance of overexpressing seedlings. In addition, when tested in a hydroponic system, rolB-PCS1 mature plants accumulated more Pb (about two fold) than control plants. We conclude that overexpression of AtPCS1 enhances Cd tolerance and accumulation and, on the basis of current results, PCs may also be required for Pb tolerance and accumulation, whereas PC-based sequestration mechanism might not be involved in tolerance of heavy metal nutrients such as Cu and Zn.

References